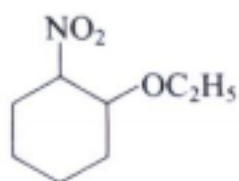


Multiple Choice Questions

Direction (Q. Nos. 1-20) Each of the question has four options out of which only one is correct. Select the correct option as your answer.

- The compound formed by elements P and Q has a cubic structure in which P atoms are at the corners of the cube and Q atoms are at the face centres. What is the formula of the compound?
(a) P_3O (b) PQ_3 (c) PQ_4 (d) P_4O
- The value of Henry's law constant for helium (He), hydrogen (H_2) and oxygen (O_2) are respectively 144.97 K bar, 69.16 K bar, and 34.86 K bar at 293 K. The correct order of their solubility is
(a) $O_2 < He < H_2$ (b) $He < O_2 < H_2$
(c) $He < H_2 < O_2$ (d) $H_2 < He < O_2$
- Which of the following is responsible for depletion of the ozone layer in the upper strata of the atmosphere?
(a) Polyhalogens (b) Ferrocenes
(c) Fullerenes (d) Freons
- The full forms of DNA and RNA are respectively.
(a) Deoxyribonucleic acid and ribonucleic acid
(b) Deribonucleic acid and ribonucleic acid
(c) Deoxyribonucleotidic acid and ribonucleotidic acid
(d) Deoxyribonucleosidic acid and ribonucleosidic acid
- IUPAC name of  is
(a) ethyl-2-nitrocyclohexane
(b) 1-ethoxy-2-nitrocyclohexane
(c) 1-nitro-2-ethoxycyclohexane
(d) 2-nitro-1-ethoxycyclohexane
- Ethylene glycol is used as an antifreeze in a cold climate. Mass of ethylene glycol which should be added to 4 kg of water to prevent it from freezing at $-6^\circ C$ will be (K_f for water = $1.86 K kg mol^{-1}$ and molar mass of ethylene glycol = $62 g mol^{-1}$)
(a) 804.32 g (b) 204.30 g
(c) 400.00 g (d) 304.60 g
- An organic compound crystallises in an orthorhombic cell in the ratio of 2:1. The dimensions of the cell are 12.05, 15.05 and 2.69 Å and density is $1.419 g/cm^3$. Find molar mass of the compound.
(a) 207 g/mol (b) 209 g/mol
(c) 308 g/mol (d) 317 g/mol

8. The ratio of the volume of a tetragonal lattice unit cell to a hexagonal lattice unit cell is

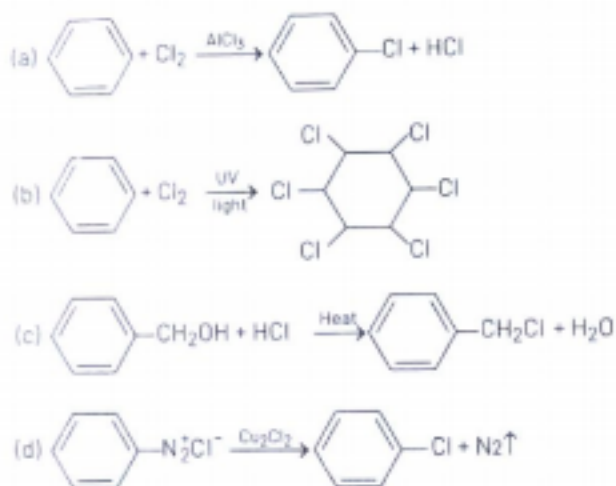
(both having same respective lengths)

- (a) 1 (b) $\frac{2}{\sqrt{3}} \frac{a^2 c}{\sqrt{3} b}$ (c) $\frac{\sqrt{3}}{2} abc$ (d) $\frac{2}{3\sqrt{3}} \frac{b}{a}$

9. What would be the molality of 20% (mass/mass) aqueous solution of KI ? (Molar mass of KI = 166 g mol^{-1})

- (a) 1.48 (b) 1.51
(c) 1.35 (d) 1.08

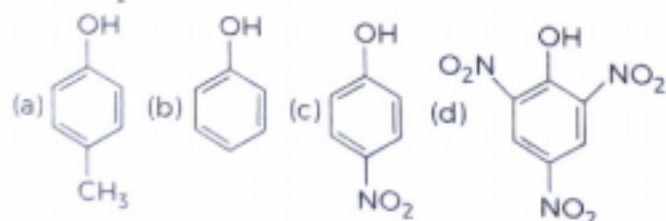
10. Among the following, the reaction that proceeds through an electrophilic substitution is



11. Among the following compounds, most basic amino acid is

- (a) serine (b) asparagine
(c) lysine (d) histidine

12. Which one is the most acidic compound ?



13. Which of the following represents Wurtz-Fittig reaction ?

- (a) $\text{C}_6\text{H}_5\text{I} + 2\text{Na} + \text{CH}_3\text{I} \longrightarrow \text{C}_6\text{H}_5\text{CH}_3 + 2\text{NaI}$
(b) $2\text{C}_6\text{H}_5\text{I} + 2\text{Na} \longrightarrow \text{C}_6\text{H}_5\text{C}_6\text{H}_5 + 2\text{NaI}$
(c) $2\text{CH}_3\text{CH}_2\text{I} + 2\text{Na} \longrightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3 + 2\text{NaI}$
(d) $\text{CH}_3\text{Br} + \text{AgF} \longrightarrow \text{CH}_3\text{F} + \text{AgBr}$

14. The structure of IF_7 is

- (a) square pyramidal
(b) trigonal bipyramidal
(c) octahedral
(d) pentagonal bipyramidal

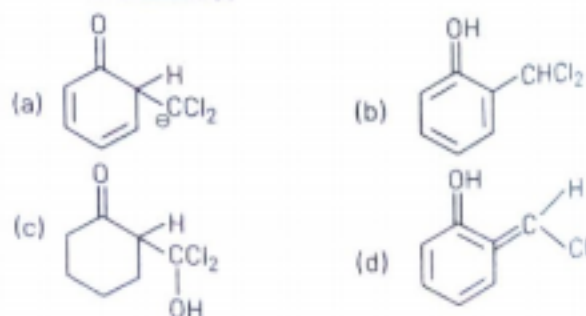
15. How is the α -form of glucose obtained ?

- (a) It is obtained by the crystallisation from concentrated solution of glucose at 317 K
(b) It is obtained by the crystallisation from concentrated solution of glucose at 303 K
(c) It is obtained by the crystallisation from hot saturated aqueous solution at 303 K
(d) It is obtained by the crystallisation from hot and saturated aqueous solution at 371 K

16. Which is the correct thermal stability order for H_2E ($\text{E} = \text{O}, \text{S}, \text{Se}, \text{Te}$ and Po) ?

- (a) $\text{H}_2\text{O} < \text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te} < \text{H}_2\text{Po}$
(b) $\text{H}_2\text{Po} < \text{H}_2\text{Te} < \text{H}_2\text{Se} < \text{H}_2\text{S} < \text{H}_2\text{O}$
(c) $\text{H}_2\text{Se} < \text{H}_2\text{Te} < \text{H}_2\text{Po} < \text{H}_2\text{O} < \text{H}_2\text{S}$
(d) $\text{H}_2\text{S} < \text{H}_2\text{O} < \text{H}_2\text{Se} < \text{H}_2\text{Te} < \text{H}_2\text{Po}$

17. When phenol is treated with CHCl_3 and NaOH followed by acidification, salicylaldehyde is obtained. Which of the following species is involved in the above mentioned reaction as intermediates?



18. In which of the following, number of lone pair at central atom is zero ?

XeO_3 , XeO_2F_2 , XeO_4 , XeO_3F_2 , XeF_6

- (a) XeO_4 and XeO_3F_2
(b) XeF_6 and XeO_4
(c) XeO_2F_2 and XeO_3F_2
(d) XeO_3 and XeF_6
19. Halogenation, Sulphonation, Friedel-Crafts reaction of haloarene comes under
- (a) nucleophilic substitution reaction of benzene
(b) electrophilic substitution reaction of benzene
(c) addition reaction of benzene
(d) elimination reaction of benzene

20. Which of the following compounds can form a Zwitter ion ?

(a) Benzoic acid (b) Acetanilide
(c) Aniline (d) Glycine

Assertion-Reasoning MCQs

Direction In the following questions (Q.No. 21-27) a statement of Assertion followed by a statement of Reason is given. Choose the correct answer out of the following choices.

- (a) Both Assertion and Reason are correct statements and Reason is the correct explanation of the Assertion.
(b) Both Assertion and Reason are correct statements, but Reason is not the correct explanation of the Assertion.
(c) Assertion is correct, but Reason is incorrect statement.
(d) Assertion is incorrect but Reason is correct statement.

21. **Assertion** Frenkel defect is produced when NaCl is doped with MgCl_2 .

Reason Mg^{2+} is bivalent and it replace two monovalent Na + from crystal lattice. At one of two sites, Mg^{2+} get seated, while other sites cation vacancy is created.

22. **Assertion** Nitration of chlorobenzene leads to the formation of *ortho* and *para* nitrochlorobenzene.

Reason $-\text{NO}_2$ group is *o* and *p*-directing group.

23. **Assertion** Fresh tomatoes are better source of vitamin C than those which have been stored for sometime.

Reason On prolonged exposure to air, vitamin C is destroyed due to aerial oxidation.

24. **Assertion** Addition reaction of water to but-1-ene in acidic medium yields butan-2-ol.

Reason Addition of water in acidic medium proceeds through the formation of primary carbanion.

25. **Assertion** ΔH_{mix} and $\Delta_{\text{mix}}V$ are zero for an ideal solution.

Reason The interaction between the particles of the components of a solution are almost identical as between the particles in liquids.

26. **Assertion** HNO_3 makes iron passive.

Reason HNO_3 forms a protective layer of ferric nitrate on the surface of iron.

27. **Assertion** Dilute solution of benzene and toluene is an ideal solution.

Reason Benzene and toluene form H-bonding with each other.

Case Based MCQs

Direction (Q. No. 28-31) Read the passage given below and answer the following questions:

The **haloalkanes** are a group of **chemical compounds** derived from alkanes containing one or more halogens. They are a subset of the general class of halocarbons, although the distinction is not often made. Haloalkanes are widely used commercially and, consequently, are known under many chemical and commercial names. They are used as flame retardants, fire extinguishants, refrigerants, propellants, solvents, and pharmaceuticals. Subsequent to the widespread use in commerce, many halocarbons have also been shown to be serious pollutants and toxins.

Haloalkanes have been known for centuries. Chloroethane was produced in the 15th century. The systematic synthesis of such compounds developed in the 19th century in step with the development of organic chemistry and the understanding of the structure of alkanes. Methods were developed for the selective formation of C-halogen bonds. Especially versatile methods included the addition of halogens to alkenes, **hydrohalogenation** of alkenes, and the conversion of alcohols to alkyl halides. These methods are so reliable and so easily implemented that haloalkanes became cheaply available for use in industrial chemistry because the halide could be further replaced by other functional groups.

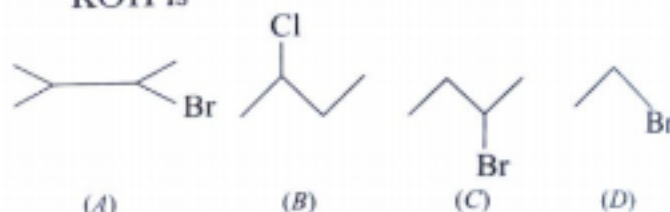
While most haloalkanes are human-produced, non-artificial-source haloalkanes do occur on Earth, mostly through enzyme-mediated synthesis by bacteria, fungi, and especially sea macroalgae (seaweeds). More than 1600 halogenated organics have been identified, with bromoalkanes being the most common haloalkanes. Brominated organics in biology range from biologically produced methyl

bromide to non-alkane aromatics and unsaturates (indoles, terpenes, acetogenins, and phenols).

Halogenated alkanes in land plants are more rare, but do occur, as for example the fluoroacetate produced as a toxin by at least 40 species of known plants. Specific dehalogenase enzymes in bacteria which remove halogens from haloalkanes, are also known.

The following questions, are multiple choice questions. Choose the most appropriate answer:

28. Correct reactivity order of the given compounds for reaction with alcoholic KOH is



- (a) $A > B > C > D$ (b) $A > C > B > D$
(c) $D > B > C > A$ (d) $A > D > B > C$

29. $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{Br} \xrightarrow{\text{Alc. KOH}}$
Final product is

- (a) propene
(b) propanol
(c) cyclopropane
(d) propan-1, 2-diol

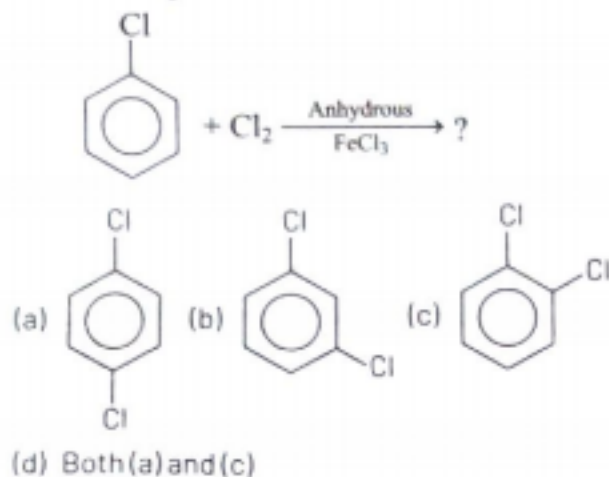
30. Arrange the following compounds in order of increasing dipole moment : Toluene (I), *m*-dichlorobenzene (II), *o*-dichlorobenzene (III), *p*-dichlorobenzene (IV).

- (a) $\text{I} < \text{IV} < \text{II} < \text{III}$ (b) $\text{IV} < \text{I} < \text{II} < \text{III}$
(c) $\text{IV} < \text{I} < \text{III} < \text{II}$ (d) $\text{IV} < \text{II} < \text{I} < \text{III}$

31. The correct order of reactivity of alkyl halides toward $\text{S}_\text{N}1$ is as follows.

- (a) $2^\circ \text{ halide} > 3^\circ \text{ halide} > 1^\circ \text{ halide} > \text{CH}_3\text{X}$
(b) $3^\circ \text{ halide} > 1^\circ \text{ halide} > 2^\circ \text{ halide} > \text{CH}_3\text{X}$
(c) $3^\circ \text{ halide} > 2^\circ \text{ halide} > 1^\circ \text{ halide} > \text{CH}_3\text{X}$
(d) $\text{CH}_3\text{X} > 1^\circ \text{ halide} > 2^\circ \text{ halide} > 3^\circ \text{ halide}$

Or
Select the product of the reaction



Direction (Q. No. 32-35) Read the passage given below and answer the following questions:

In physics and chemistry, a molecule is an electrically neutral, group of atoms that can exist alone in a free state while its characteristic properties are retained. The atoms comprising the molecule may be of the same kinds.

A biomolecule refers to any molecule that is produced by living organisms. As such, most of them are organic molecules. The four major groups of biomolecules include polysaccharides, amino acids and proteins, nucleic acids (DNA and RNA), and lipids found in and produced by living organisms. Thus, many of the biomolecules are polymers. A polymer is a compound made up of several repeating units (monomers) or protomers and produced by polymerisation. Most of these biomolecules are organic compounds.

A **nucleic acid** is a biomolecule composed of monomeric units of nucleotides. Each

nucleotide, in turn, is comprised of phosphoric acid, sugar (5-carbon), and nitrogenous base. Nucleic acids may be in the form of DNA or RNA molecules.

A part from serving as a structural unit of nucleic acids, nucleotides may also serve as sources of chemical energy. Nucleotides may also act as cofactors of some enzymatic reactions.

A protein is a biomolecule composed of **amino acids** joined together by peptide bonds. It has the basic formula of $\text{NH}_2\text{CH(R)COOH}$. Amino acids are classified as to whether they are non-essential or essential. There are about a hundred natural amino acids identified.

Other biomolecules are metabolites and natural products. A metabolite refers to any substance produced by metabolism or by a metabolic process.

Examples of metabolite are alcohols, amino acids, antioxidants, nucleotides, organic acids, vitamins, polyos, alkaloids, terpenoids, etc. Natural products include biologically-derived materials, bio-based materials, and bodily fluids.

In these questions, a statement of Assertion followed by a statement of Reason is given. Choose the correct answer out of the following choices :

- Assertion and Reason both are correct statements and Reason is correct explanation for Assertion.
- Assertion and Reason both are correct statements but Reason is not correct explanation for Assertion.
- Assertion is correct statement but Reason is incorrect statement.
- Assertion is incorrect statement but Reason is correct statement.

32. Assertion α -Amino acids exist as dipolar ions or zwitter ions.

Reason α -Amino acids are the building blocks of proteins.

33. Assertion Valine is an essential amino acid.

Reason The lack of essential amino acids in the diet causes Kwashiorkor.

34. Assertion β -pleated sheet structure of protein shows maximum extension.

Reason Intermolecular hydrogen bonding is present in them.

35. Assertion Alpha (α)-amino acids exist as internal salt in solution as they have

amino and carboxylic acid groups in near vicinity.

Reason H^+ ion given by carboxylic group ($-\text{COOH}$) is captured by amino group ($-\text{NH}_2$) having lone pair of electrons.

Or

Assertion The specific rotation of a freshly prepared solution of α -glucose decreases from $+112^\circ$ to 52.7° while that of β -glucose increases from $+19^\circ$ to 52.7° .

Reason The change in specific rotation of an optically active compound with time to an equilibrium value is called mutarotation.